



Birds and Blooms:

BeachCOMBERS Document Significant Harmful Algal Blooms in the Monterey Bay National Marine Sanctuary, 1997 – 2009

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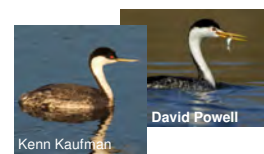
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Methods

We use standardized survey methods to obtain baseline rates of seabird deposition (birds / km/mo.) along area beaches, and to identify unusual mortality events.

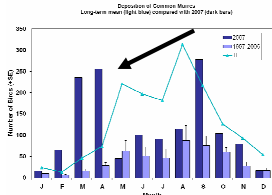
- Two observers per beach
- Same survey segments each month (1-3 km, see map left)
- Volunteers are trained to identify marine birds and mammals
- Standard Datasheets
- Birds marked to avoid double-counting



Results

During 1997 - 2009 we documented 16 significant mortality events as evidenced by monthly carcass deposition exceeding the "Threshold Level" (TL, see left). The TL is the long-term mean (1997-2007) plus two standard deviations. In comparisons among events using the cumulative proportion of deposition exceeding TL we found an increase in HABs and environmentally-driven die-offs. In recent years (2005 to present), the frequency (1 to 2) and severity of mortality events related to algal blooms indicated by an order of magnitude increase in deposition rates of marine birds relative to past. We provide a relative measure of the relative frequency and severity of bird die-offs in the Sanctuary in the past and provide a framework to evaluate the significance of future mortality events.

Western and Clark's Grebes are nearshore birds that breed inland at lakes and winter in coastal waters where they may be affected by algal blooms.



Threshold Level (TL) – When deposition for a given month exceeds TL, the event is considered "unusual".

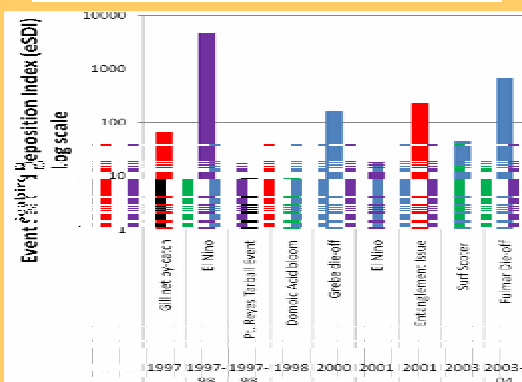
An increasing trend?

Causes of these bird die-offs were attributed to a variety of sources, including:

- human activities such as fishery bycatch
- oil spills
- natural phenomena such as starvation due to upwelling failure (e.g. 1997, 2005, 2009)
- harmful algal blooms (1998, 2007 Domoic acid, 2007 Akashiwo).

Given that phytoplankton blooms are ephemeral in space and time, and not easily captured by current sampling regimes, our results are probably underestimating the frequency at which these HABs are affecting marine birds in Monterey Bay.

Relative Importance of Mortality Events (1997-2009)

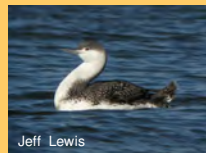


The standard deposition index (cumulative proportion exceeding TL)

Introduction

The Coastal Ocean Marine Bird and Mammal Education and Research Surveys (BeachCOMBERS) has conducted monthly surveys to monitor changes in the deposition of beached birds and mammals in the Monterey Bay National Marine Sanctuary since May 1997. This program is dependent upon trained volunteers who serve as "citizen scientists" collecting valuable information in a standard manner to provide important information about the status of marine birds and mammals in the sanctuary.

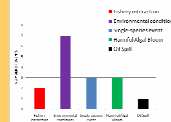
"Killer Foam" Algal Bloom



Red-throated Loon – an migratory seabird which is susceptible to harmful algal blooms and Loons breeds in summer in inland lakes and winters in coastal waters of Monterey Bay.

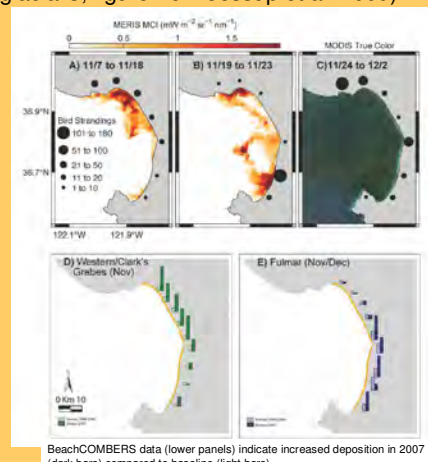


During the third wave of strandings in the 2007 Akashiwo HAB, the pelagic Northern Fulmar was the predominantly affected.



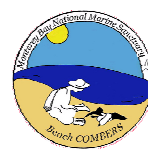
Relative to other events, HABs are among the top cause of episodic mortality events in Monterey Bay (left).

During the Nov.-Dec 2007 Akashiwo event, we documented increased deposition of nearshore species, including sea ducks (Melanitta spp.), loons (Gavia spp.), grebes (Aechmophorus spp.), and one offshore species, the Northern Fulmar (Fulmarus glacialis; figure from Jessup et al. 2009)



BeachCOMBERS data (lower panels) indicate increased deposition in 2007 (dark bars) compared to baseline (light bars)

Thanks...
BeachCOMBERS
volunteers!



Interested in becoming a
volunteer? Contact: Erica
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